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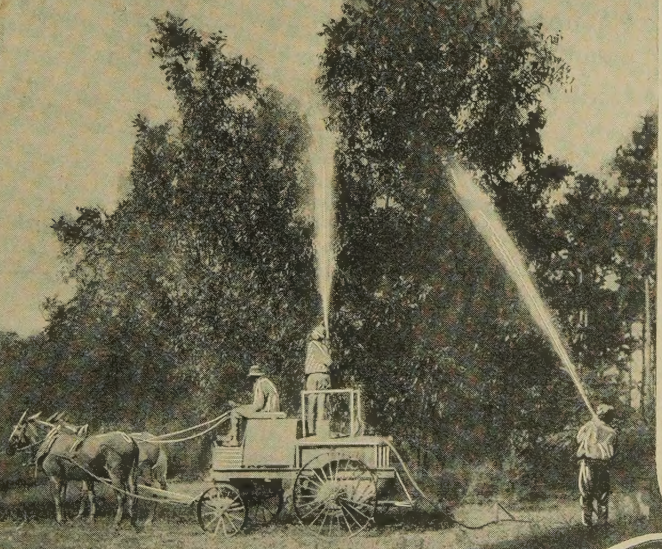
DISEASES of SOUTHERN PECANS



THIS BULLETIN is intended to aid nurserymen, growers, and prospective growers in obtaining a more thorough and definite knowledge of the various diseases of the pecan, the extent of their distribution, and their relative importance.

Observed facts are stated as facts and opinions as opinions, and every effort has been made to avoid confusing facts with opinions.

Typical illustrations are presented wherever these will contribute to the text and be an aid in recognizing the diseases discussed.

Where remedies are known they are given, and where they are not known such information as is available is presented.

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Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief
Washington, D. C. September, 1920

DISEASES OF SOUTHERN PECANS.

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IT IS THE PURPOSE of this bulletin to give in a concise, clear, and nontechnical manner such information on pecan diseases as is at present available. The matter here presented is based not only on the observations and experiments of the writers, but upon all reliable sources of information. It is intended to apply to commercial orchards of the southern and southeastern coastal plain of the United States, but not to the so-called northern pecans, originating in the latitude of southern Indiana or farther north, which are adapted to producing their crop in a growing season of 200 days or less and are subject to climatic conditions very different from those of the southern pecans.

Rosette and scab are the most serious diseases of the pecan, but other troubles are also the cause of a loss of trees and nuts. An understanding of the nature of these troubles will be of substantial benefit to growers and nurserymen.

DISEASES DUE TO SPECIFIC ORGANISMS.

SCAB.[1]

Scab is a fungous disease of the leaves, twigs, and nuts. Figure 1 shows a typical case of leaf infection. The small, velvety, black spots on leaves are seldom sufficiently numerous to do serious damage. The appearance of the diseased spots on the twigs is quite similar to that on the leaves, but the damage done by twig infec-

[1] Caused by *Fusicladium effusum* Wint.

tion may be much more serious. In cases of severe infection the tips of the twigs are killed. The greatest damage is caused by the fungus attacking the nuts. Figure 2 shows a typical case of nut infection. When this infection occurs early in the season the diseased nuts drop before maturity, and late summer infection results in undersized, faulty nuts.

The southern pecan belt is fairly well confined to that portion of the South in which cotton is grown. Although scab is found throughout this territory, serious damage is confined to a limited number of varieties of pecans grown in the warmer and more humid sections.

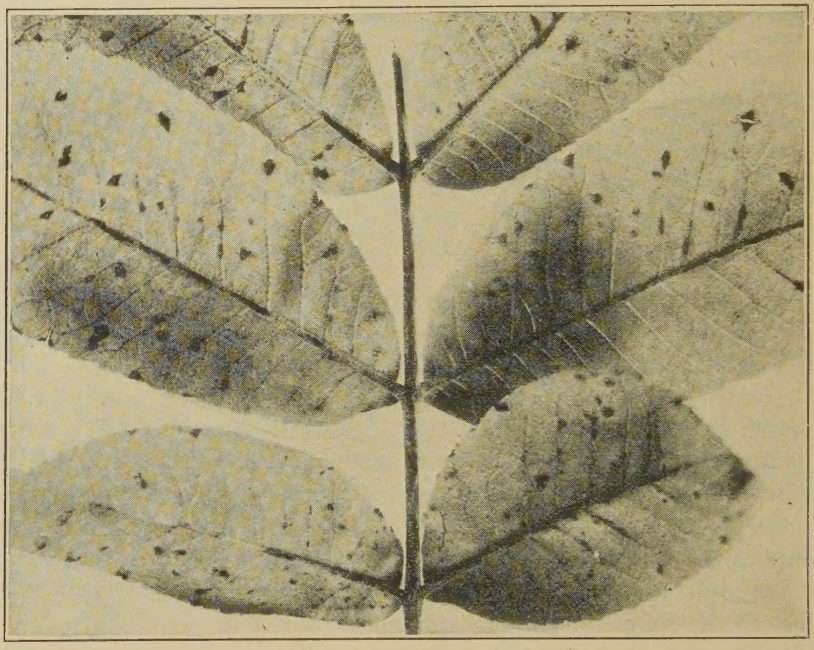

FIG. 1.—A portion of a pecan leaf typically marked by the scab fungus. The spots are raised, velvety, and black in color.

The disease becomes less serious as one proceeds inland from the Gulf and Atlantic coasts; 150 miles inland it is of relatively minor importance. Certain varieties which can not be grown successfully near the coast are but slightly attacked at this distance inland, and other varieties only slightly susceptible to infection near the coast are here entirely free from the disease.

There is great variation in the susceptibility of varieties. Certain sorts are entirely immune, while others so readily succumb to the disease that they can not be grown commercially. All gradations exist between these two extremes. Among the most susceptible varieties are the San Saba, Georgia, and Delmas. The Van Deman, Schley, Pabst, and Bolton pecans follow these in degree of susceptibility and

are sometimes seriously affected. The Mobile, Alley, Moore, and Nelson varieties are usually free from the disease, but suffer some loss occasionally, while the Stuart, Frotscher, Moneymaker, Teche, Russell, and Success are so highly resistant as to be practically immune. Infection is most serious during seasons of frequent rains and heavy dews, when the crop of the most susceptible varieties is usually completely destroyed.

The control of scab can best be effected by the propagation of immune or highly resistant varieties. Established orchards of susceptible sorts may be and are successfully top-worked to scab-resistant varieties. The use of resistant varieties only is strongly recommended in all orchards within 150 miles of the Gulf and Atlantic coasts. In orchards which the owners do not wish to top-work scab can be successfully controlled by spraying.

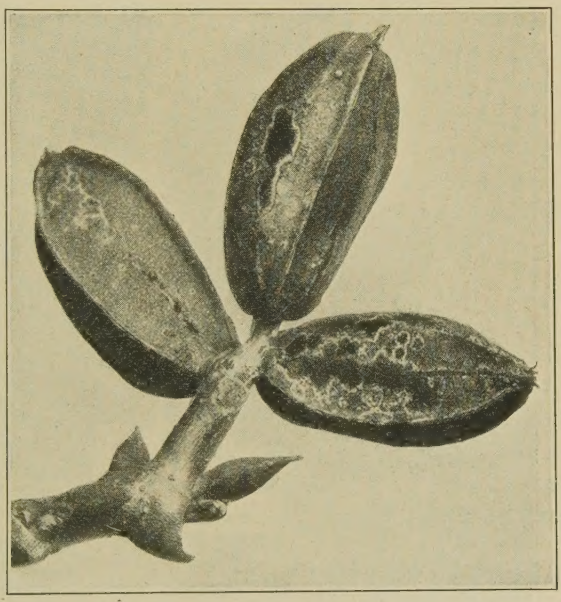

FIG. 2.—Pecans infected by the fungus causing the scab. Nuts on which the disease has developed to the extent here shown almost invariably fall from the tree before reaching maturity.

A standard Bordeaux mixture composed of 4 pounds of bluestone (copper sulphate), 4 pounds of quicklime, and 50 gallons of water has been found to be the most satisfactory fungicide for preventing scab. The addition of 1 pound of resin-fishoil soap to each 50 gallons of the preparation is recommended, as it materially increases the spreading and sticking qualities of the mixture.

Spraying to control scab is essentially a preventive measure. If the nuts are kept covered with the fungicide from the time they are formed, about the first of May, until the first of September, when growth is almost complete, scab infection will be prevented. Although this is difficult it can be done sufficiently well to save a large part of the crop on so highly susceptible a variety as the Delmas in a season of severe infection. Definite rules can not be given for the number of applications to be made. This will depend

entirely on the frequency and the amount of rain. The only rule that can be followed is to keep the nuts covered with the fungicide from the time they are formed until September 1. This usually requires three to five sprayings, and it can not be too strongly emphasized that merely shooting the spray into the tree is not sufficient. The work must be done carefully and the nut clusters covered. Careful work in this connection is not incompatible with rapid work, but for the spraying to be done thoroughly as well as rapidly it is necessary that the workmen understand the purpose of the spraying to be done and then use care in attaining that purpose.

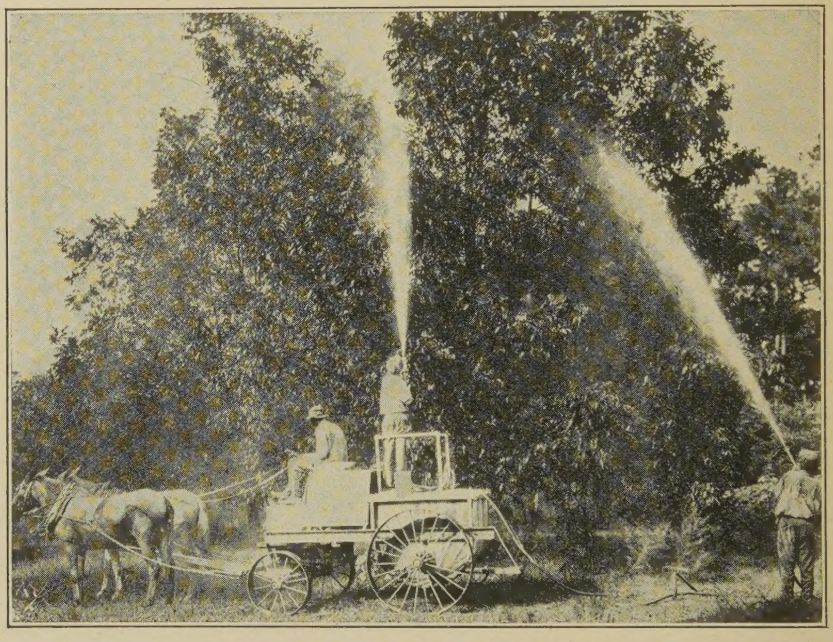

FIG. 3.—A high-power spray machine at work in a pecan orchard. These trees were about 40 feet high, but no difficulty was experienced in doing a thorough job of spraying with this type of outfit.

The size of the orchard and the height of the trees must determine the size and capacity of the spray machine to be used. The low-power machines designed to spray peach and apple orchards have proved decidedly unsatisfactory in any but young pecan orchards. Pecan trees grow to great height. Trees 50 to 60 feet high are not uncommon, and trees 35 to 40 feet high are frequently found in bearing orchards of the South. The ordinary 3 to 4 horsepower spray machine with extension rods and tower can not be expected to do satisfactory work beyond 30 feet from the ground. Figure 3 shows a type of machine well adapted for spraying tall pecan trees. It is equipped with a 10-horsepower engine and a pump of sufficient capacity to discharge 20 gallons of liquid per minute

through two lines of hose. Spray guns are used instead of extension rods, and the operators work from the ground and from the top of the tank. The pressure developed, 250 to 350 pounds as shown on the gauge, is sufficiently powerful to carry a large volume of liquid in the form of a fine spray to the tops of 50-foot trees. Liquid thrown with such force enables the operator to spray the center of the trees as well as the outside.

High-pressure sprayers require specially constructed hose and hose connections. It is a great annoyance to try to operate a high-pressure outfit with the ordinary type of hose and connection. Such a machine throws out the material freely, and the problem of refilling is of considerable importance. Unless convenient refilling facilities are arranged, more time is usually consumed in driving to the water supply and loading than in spraying. This problem can best be solved by having one or more teams haul the water and spray materials to the sprayer. Provision can be made to fill the supply wagons by a gravity system. The high-power machines are usually equipped with a tank filler operated by the spray motor, which will fill the spray tank at the rate of 30 to 40 gallons a minute.

NURSERY BLIGHT.[2]

Nursery blight is principally a disease of nursery stock, but it is occasionally found on mature trees. The disease is favored by any factor reducing the vitality of the trees. The strong competition between the trees in the nursery seems to be especially favorable for its development. Mature trees planted too closely or those neglected in care and cultivation are sometimes damaged slightly. This disease is also frequently found on rosetted trees.

Nursery blight is found only on the leaves. The first infections usually appear in April as very small reddish spots with a white speck in the center. Single spots are seldom more than one-eighth of an inch in diameter. Frequently two or more spots unite, forming a larger spot. The older infections appear almost white, surrounded with a dark-brown border. The spots appear dark brown on the under surface of the leaves.

While the infections may occur at any point on the leaf surface they are most commonly found along the midrib and larger veins. Often they grow together along the midrib, forming an elongated spot the length of the leaflet. The leaflet shown in figure 4 is typical of this trouble.

Nursery blight is controlled successfully by spraying with Bordeaux mixture. The first application should be made after the leaves develop and before infection begins. In southern Georgia

[2] Caused by *Phyllosticta caryae* Peck.

this is usually about the middle of April. The number and frequency of applications must be determined by the amount of rainfall.

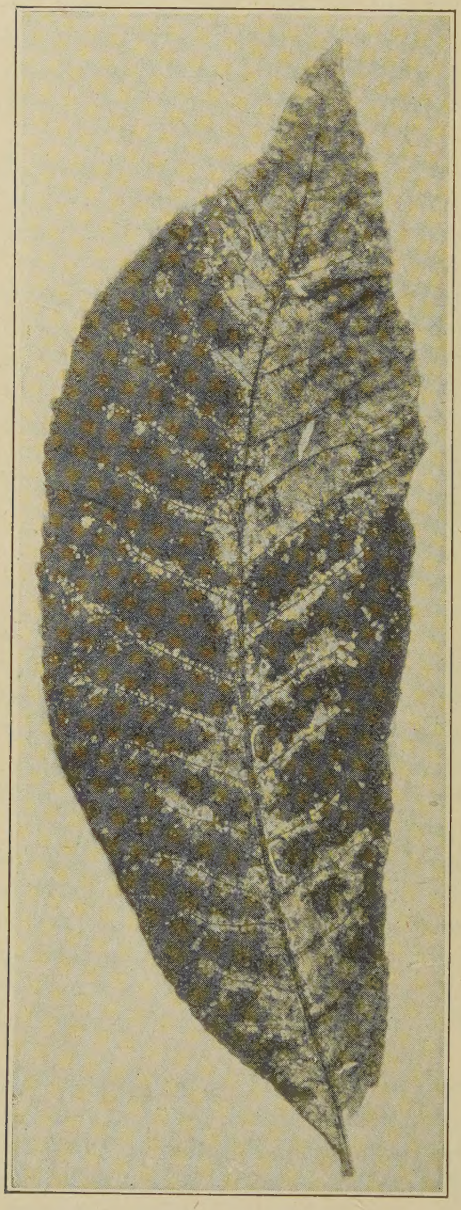

FIG. 4.—A leaflet seriously affected by nursery blight.

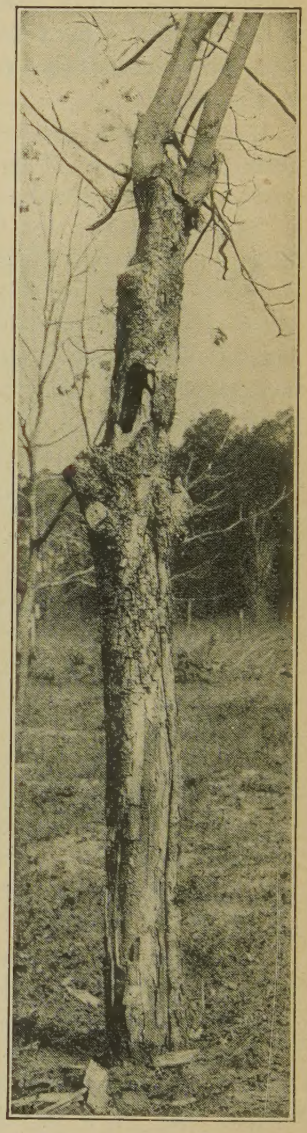

FIG. 5.—A badly pruned and neglected top-worked pecan tree. This tree is a total loss.

To prevent the disease it is necessary that the leaves be kept well covered with the fungicide, and three to five sprayings will usually accomplish this result.

WOOD-ROTTING FUNGI.

Wounds made in pruning pecan trees and those arising from other mechanical injuries, such as careless cultivation, hail, winter injury, and windstorms, are all possible points of entrance for wood-rotting fungi. The hot, humid climate of the Southeastern States favors the rapid development of the fungi, and unless wounds are given

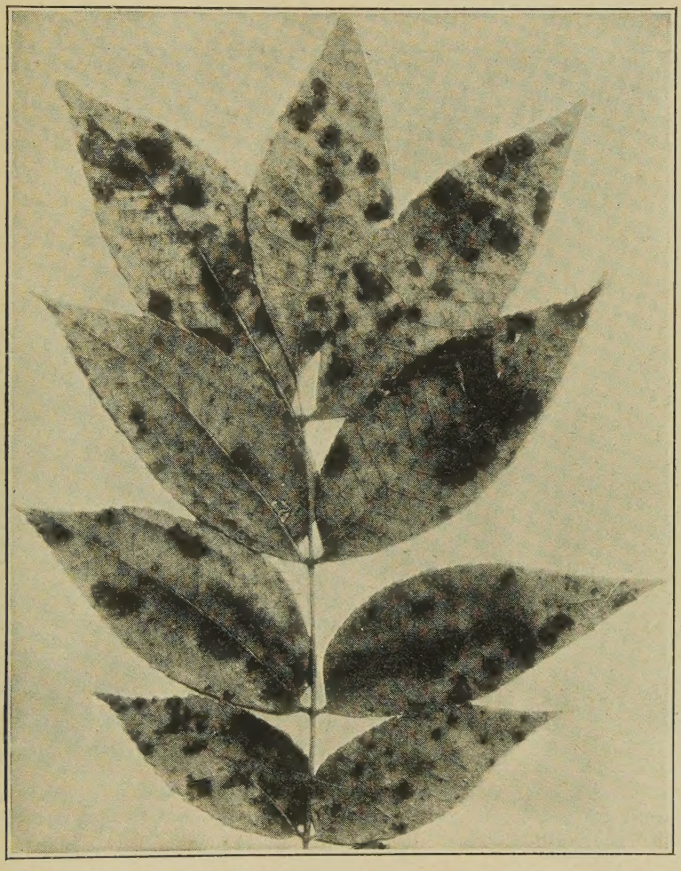

FIG. 6.—The characteristic appearance of a pecan leaf affected with the brown leaf-spot.

protection from infection and so handled as to facilitate healing, it is almost inevitable that fungi will gain entrance and endanger the entire tree.

While pruning in some pecan orchards has been properly done, this is not universally the case. The orchards which have been handled badly in this respect are probably in the minority, but it is a fact that wood-rotting fungi, entering through wounds, are weakening trees in many orchards. Trees affected in this way will fre-

quently stand for many years, but the reduction of their life and crop-producing power is inevitable. That losses of this nature have not already been felt is explained by the newness of the industry.

Figure 5 shows a tree which was a total loss on account of the ravages of wood-rotting fungi entering through wounds improperly made and left unprotected. The matter of protecting pecan trees from wood-rotting fungi has been fully discussed by the senior writer in another bulletin.[3]

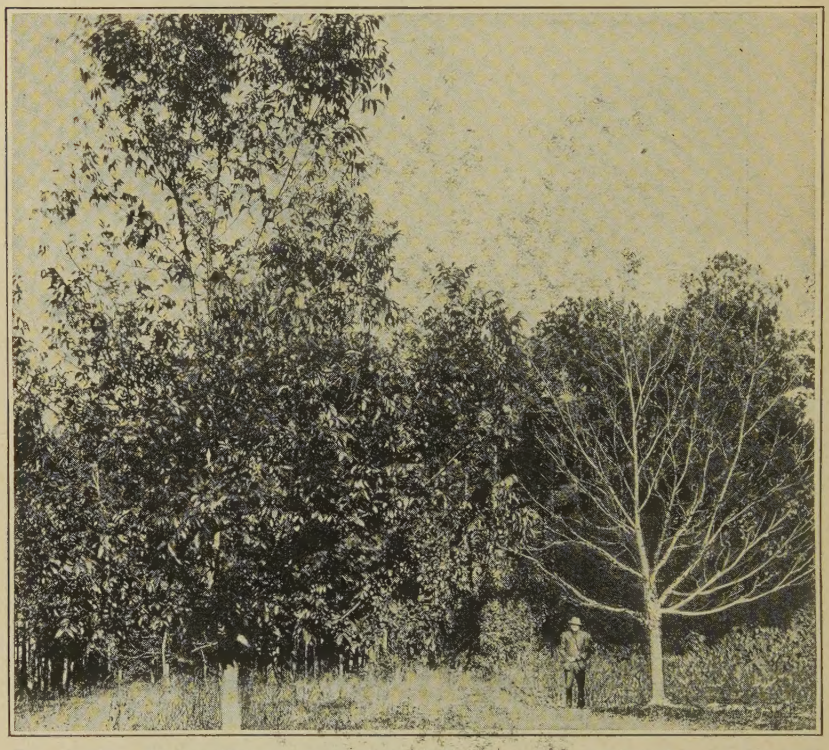

FIG. 7.—The unsprayed tree in the right background was defoliated by brown leaf-spot, while the tree in the left foreground which had been sprayed with Bordeaux mixture was free from disease.

BROWN LEAF-SPOT.[4]

A pecan leaf characteristically marked by the brown leaf-spot is shown in figure 6. These spots, ranging from one-eighth to one-half of an inch in diameter, are usually reddish brown in color, though the old spots not infrequently become grayish and develop concentric rings. This is the most common leaf disease of the pecan and is distributed throughout the pecan belt.

[3] McMurran, S. M. Preventing wood-rot in pecan trees. U. S. Dept. Agr., Farmers' Bul. 995, 8 p., 10 fig. 1918.

[4] Caused by *Cercospora fusca* Rand.

These spots usually appear about the middle of July, though they are occasionally found earlier in the season on mature leaves, but not on young, tender growth. They rapidly increase in number and size toward the end of the growing season and occasionally cause some premature loss of foliage. Leaves of trees weakened from any cause are particularly susceptible to infection by the fungus causing brown leaf-spot, and such trees frequently shed their foliage a month before their healthy neighbors as a result of a severe attack of this disease.

The disease can be controlled by spraying with Bordeaux mixture, and figure 7 shows in the left foreground a sprayed tree in practically full foliage, while its unsprayed neighbor is completely defoliated. Beginning on July 1, the tree in foliage received three sprayings at 3-week intervals.

Since this disease appears only during the latter half of the growing season and does no serious damage to vigorously growing well cared for trees growers need not concern themselves with its control other than to keep their trees in a thrifty condition.

FIG. 8.—Typical specimen of crown-gall on a young pecan tree.

CROWN-GALL.[5]

Crown-gall is a distinctly minor disease of the pecan, on account of its rare occurrence. It is here brought to the attention of growers, as it had been occasionally observed. As the name implies, this disease manifests itself as an enlargement on the roots or collar of the tree. Figure 8 shows a typical case of the crown-gall. Nursery trees should be inspected before planting, and those showing galls should be discarded, as trees infected with this disease may develop more slowly in the orchard.

ANTHRACNOSE.[6]

The anthracnose of the pecan has been found by the writers only on the mature or very nearly mature husks of the nuts, as shown in

[5] Caused by *Bacterium tumefaciens* Sm. and Town.
[6] Caused by *Glomerella cingulata* (Stonem.) S. and V. S..

figure 9. These black, irregular, sunken spots can scarcely be called a diseased condition, as growth is practically complete when they appear. So far, the anthracnose has done no damage and for the present may be disregarded by growers.

POWDERY MILDEW.[7]

Powdery mildew is a surface growth found on the leaves and nuts. It appears during May and June, especially during seasons of considerable rainfall and high humidity.

Owing to its habit of coating the leaves and nuts with a white powdery growth, it frequently causes growers some concern. The writers have observed this disease as appearing rather commonly throughout the pecan belt, but have no record of its doing any noticeable damage to either the leaves or the nuts. During dry weather the fungus disappears. Infected nuts develop normally and show no evidence of injury.

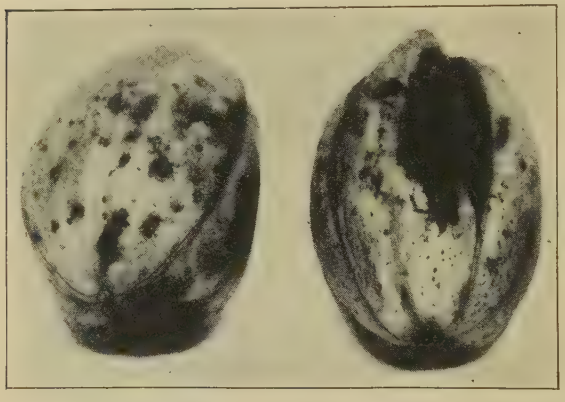

FIG. 9.—Spots on the husks of mature pecan nuts caused by the anthracnose fungus.

MISTLETOE.[8]

Mistletoe is rarely seen in well cared for orchards, but it is common on individual trees, particularly old trees which receive no care. Figure 10 shows an old seedling tree heavily infected with mistletoe. This plant is an active parasite. It penetrates the tissues of the tree and draws its nourishment from it. When any value is attached to a tree the mistletoe should be removed, care being taken either to kill the root by applying carbolineum or to cut it out.

DIEBACK.[9]

A disease of pecan limbs and twigs termed dieback was first reported by Fawcett [10] and later by Stevens [11] and by Matz.[12]

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[7] Caused by *Microsphaera alni* Wallr. Wint.

[8] For a full discussion of the mistletoe and its various host plants, see Bray, W. L., The mistletoe pest in the Southwest. U. S. Dept. Agr., Bur. Plant Indus. Bul. 166, 39 p., 7 fig., 2 pl. 1910.

[9] Caused by *Botryosphaeria berengeriana* De Not.

[10] Fawcett, H. S. Dieback. *In* Fla. Agr. Exp. Sta. Rpt. [1908]/1909, p. lxi. 1909.

[11] Stevens, H. E. Pecan diseases. *In* Fla. Agr. Exp. Sta. Rept. [1914]/1915, p. xci. 1915.

[12] Matz, J. Pecan dieback. *In* Fla. Agr. Exp. Sta. Rpt. [1915]/1916, p. 99R–107R. 1916.

———. Pecan dieback. *In* Fla. Agr. Exp. Sta. Rpt. [1916]/1917, p. 87R–89R. 1917.

It appears from Matz's investigations that the fungus responsible for the disease is but weakly parasitic; that it causes little or no injury to vigorously growing healthly trees, but that it will produce cankers and even kill twigs and limbs of trees lacking in vigor, as, for example, those suffering from rosette or from winter injury.

This disease appears to be of distinctly minor importance at present, and there is little likelihood of its causing any material damage to well cared for, vigorous orchards. When it occurs, diseased limbs should be pruned out and destroyed.

FIG. 10.—An old and neglected pecan tree carrying a large amount of mistletoe.

DISEASES DUE TO ENVIRONMENTAL FACTORS.

ROSETTE.[13]

Rosette is a disease of the tree and has so far proved to be the most serious with which the pecan industry has to contend. In its earliest stages rosette is indicated by a few small, wrinkled, yellow-mottled leaves at the end of the branches. All gradations of the disease are found between that shown by these first symptoms and the condition illustrated in figure 11, where the trees are dying. The writers have never seen a tree which has died as a direct result of rosette, but affected trees become so weakened that frequently they are killed by winter injury and by borers. Seriously affected trees rarely bear nuts, and they make but little growth.

The conditions under which this disease occurs give the key to its cause and prevention. By far the most of it is found on soils which are obviously lacking in plant-food material, in humus, and in moisture-holding capacity; for instance, eroded hillsides or fields which have been cropped to the point of exhaustion, as evidenced

[13] For a full discussion of pecan rosette and experiments for its control, see McMurran, S. M., Pecan rosette in relation to soil deficiencies. U. S. Dept. Agr. Bul. 756, 11 p., 4 fig. 1919.

by the poor, yellow growth of weeds which they produce. Cases are also found on soils which on superficial examination are apparently well suited to the production of healthy trees, but the subsoil invariably shows some form of hardpan, heavy impervious beds of clay, or soft white sand. In other words, the rosette is found on soils which are for some reason ill suited to conserve moisture or to give up moisture and its content of plant-food material when needed.

The native habitat of the pecan is the banks and second bottoms of the Mississippi and its tributaries and other streams of the Southwest. The soils in these places are of uniform formation to a

FIG. 11.—Typical specimens of badly rosetted pecan trees.

great depth and are frequently supplied by overflow with enriching material. The pecan has been growing in such soils through an unknown number of centuries, and trouble is sure to follow if orchards are set on poor or badly formed soils.

The rosette may be overcome on soils readily susceptible to improvement by consistently following some soil-building policy, such as the annual use of stable manure and leguminous cover crops, but it appears that in most instances cases of the disease caused by bad subsoil conditions had best be abandoned. An exception to this statement should be noted where the trouble is caused by the so-called piney-woods hardpan. This formation can be readily broken by small charges of explosives, and growers report a quick recovery of diseased trees when this is done.

WINTER INJURY.

A typical case of winter injury is shown in figure 12. The affected tree put out its leaves in the spring, grew for several weeks on the food stored in its trunk and limbs, and then withered. An examination made at that time (May 5) showed the trunk to be completely dead for a foot above the ground. Above that the trunk and limbs showed no evidence of injury. Quite frequently trees injured in this manner send up shoots from below the ground line, as shown in figure 13. In this case, also, the trunk of the tree for about a foot above the ground had been

FIG. 12.—A young pecan tree killed at the collar by extreme cold. The top had leaved out and then quickly wilted and died. This is the typical condition of winter-injured trees in the spring. Later in the season they usually send up shoots from the uninjured roots.

FIG. 13.—A typical case of winter injury. The tissue between the white band and the surface of the ground was completely killed, and new sprouts came up from the uninjured roots. This is the usual condition about midsummer.

completely killed by extreme temperature changes; the top had grown for a few weeks, then withered and died; and the roots had thrown up shoots.

This trouble is caused by sudden and excessive changes in temperature during the late fall and winter. Young trees which are making a vigorous late growth are most susceptible. If the damage is discovered early in the spring, the injured portion will be found to have a soft, darkened, watery appearance and usually a sour odor. As a result this type of injury is known as sour-sap, or sun scald. Within a few weeks after the tissues are damaged shot-hole borers usually riddle the bark with many small holes. This, however, is a secondary trouble. This group of insects rarely injures healthy pecan trees, but, on the other hand, almost invariably attacks dead or dying trees.

FIG. 14. — Young pecan tree showing the method of wrapping to prevent winter injury. It has proved very effective in eliminating the trouble.

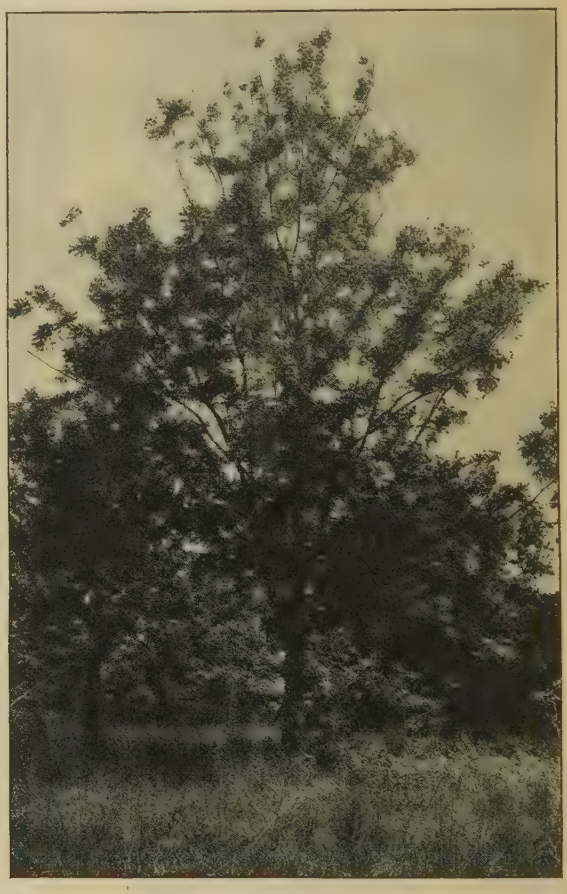

FIG. 15.—A mature neglected seedling pecan tree showing the condition known as staghead. The ends of the branches in the top of the tree are mostly dead.

Winter injury causes a loss of many young trees annually, and must be considered a rather serious problem to the owner of a young orchard. So far as the writers are informed it has never been reported on trees over 9 years of age. In younger orchards, however, it is necessary to guard against this source of loss. By avoiding cultivation and fertilization after midsummer and by sowing cover crops in June or July, the growth of the trees will be checked and their susceptibility to cold reduced. In certain orchards with which the writers are familiar the above practices did not prove sufficiently effective to eliminate losses, so the owners resorted to wrapping the bodies of the trees each fall with old fertilizer sacks, as shown in figure 14, which were removed in the spring. This practice prevented further trouble.[14]

FIG. 16.—Pecan leaflets showing two stages of tipburn, a condition caused by excessive evaporation.

STAGHEAD.[15]

A typical case of this disease is shown in figure 15. It is a rather uncommon trouble and can not be considered serious. In the writers' observations it has occurred only on mature trees, usually old trees, which have been totally neglected so far as cultivation and fertilization are concerned. The foliage of trees so affected is green and healthy in appearance. Most of the dying of the branches is confined to the tops of the trees. Repeated examinations of the dead wood for evidence of parasitic organisms have given negative results.

Because of the merely occasional occurrence of this disease on isolated trees or small groups of trees, no experiments have been conducted to remedy it, but suitable cultivation, fertilization, and pruning to remove the dead wood will probably so stimulate the vigor of affected trees as to free them from the trouble.

TIPBURN.

A typical case of tipburn is shown in figure 16. This trouble invariably starts by a browning of the tip, the margin, or sometimes

[14] For a discussion of winter injury to fruit trees, the reader is referred to Waite, M. B., Fruit trees frozen in 1904. U. S. Dept. Agr., Bur. Plant Indus. Bul. 51, p. 15–19. 1905.

[15] The condition here described was first reported by the senior writer under the name dieback. See McMurran, S. M., Notes on pecan diseases. *In* Amer. Nut Jour., v. 4, no. 6, p. 81, 86, illus. 1916. The trouble is identical with the disease described by Hartig as staghead, and it appears desirable to use the term already associated with this type of disease. (Hartig, R. Text Book of the Diseases of Trees, p. 270. London, 1894.)

both tip and margin, of the leaflets and, if the weather conditions are sufficiently severe, progresses until the whole leaf is dead.

It is of rather common occurrence, but is not serious. It occurs during prolonged periods of excessively hot, sunny days. No actual measurements have been made or experiments conducted to prove that this trouble is due to excessive evaporation, but the writers' knowledge of similar trouble on other plants and the known conditions under which they have observed it on the pecan convince them that it is due to excessive evaporation occurring under the conditions above stated.

FIG. 17.—Typical cases of kernel spot.

DISEASES DUE TO UNKNOWN CAUSES.

KERNEL SPOT.

Typical cases of kernel spot are shown in figure 17. This is a trouble which occurs principally on thin-shell pecans. It is found quite as frequently on the nuts produced by native seedling trees of the Southwest as on those from planted orchards. The spots develop toward the last of the growing season, after the kernels are almost mature, but no evidence of the disease can be seen until the kernels are removed from the shells.

In some preliminary investigations Rand[16] found a fungus associated with the diseased kernels. More recently Turner[17] has suggested that certain sucking insects may be the cause. Pecan growers at various points in the South have stated repeatedly to the writers that the appearance of sucking insects during the summer is invariably followed by a more or less seriously affected crop of nuts. The most that can be said at this time is that the disease is a matter for further investigation, and until the cause is definitely determined no recommendations for its control can be made.

It is difficult to estimate the extent of this trouble, on account of the fact that the pecans from planted orchards do not go to the crackeries, but are widely distributed in the shells to consumers. The disease is more serious in some seasons than others, and occasionally orchards produce a crop of nuts a large proportion of which is affected, but these cases are rather uncommon, and so far as the writers have been able to learn, the disease is not increasing. Fur-

[16] Rand, F. V. Some diseases of pecans. *In* Jour. Agr. Research, v. 1, no. 4, p. 303–338, 5 pl. 1914.

[17] Turner, W. F. Nezara viridua and kernel spot of pecan. *In* Science, n. s., v. 47, p. 490–491. 1918.

ther investigations doubtless will throw sufficient light on the cause of these spots to make possible the development of preventive measures.

BLACK-PIT.

The first observable stage of black-pit consists of an internal browning of the nut and a disorganization of the internal tissues with no external evidence of the trouble, as shown in figure 18. The dead, brown internal tissues are surrounded in the beginning by a husk that is green and apparently normal in every respect. No evidence of infection or injury of any sort is to be found on the outside of the nut in the early stages of the disease. However, as the disease progresses the nuts take on the appearance shown in figure 19. Sunken, glossy black spots and blotches appear, and shortly thereafter the nut falls to the ground. This disease usually appears about midsummer.

FIG. 18.—An early stage of black-pit. The internal tissues are brown and disorganized, but the surrounding husk is still green and shows no sign of injury.

The disease is much more serious in some years than others. Taking year with year, however, it can not be said that black-pit has been a source of serious loss. The writers have observed that in seasons of light occurrence the trouble usually affects only one or two nuts in a large cluster, thus suggesting a sort of natural pruning by which the number of nuts in a cluster is reduced. This is not always the case, however, for indivdual nuts showing the trouble can be found. It remains for further investigation to throw light on this very obscure disease; but there is no reason to suppose that it will become more serious in the future than it has been in the past.

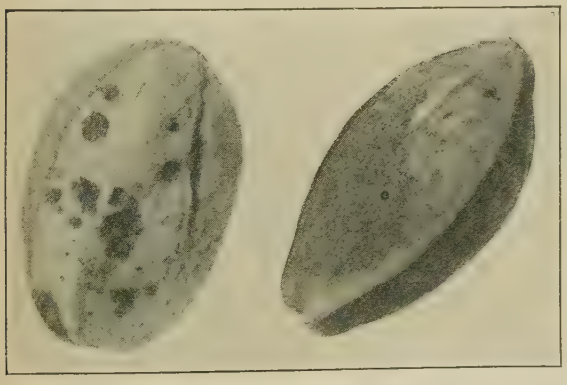

FIG. 19.—A later stage of black-pit. The nuts fall from the tree soon after the sunken black spots and blotches appear on the husks.

SURFACE GROWTHS ON PECANS.

Very frequently in neglected and occasionally in well cared for vigorously growing orchards, trees will become more or less covered

with nonparasitic superficial growths. Figures 20, 21, and 22 show fungous growths that will be readily recognized by most growers. These growths are entirely superficial and except for marring the appearance of the trees do little or no harm.

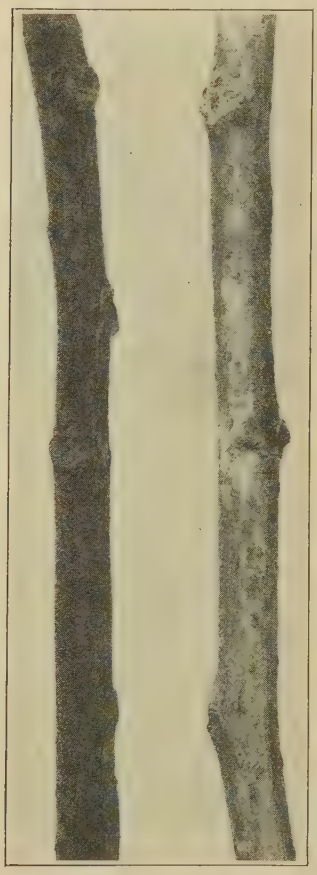

FIG. 20.—The twig on the left is blackened by sooty mold, a superficial growth which discolors the twig but does no harm. The twig on the right is free from the fungus and is presented by way of contrast.

Lichens[18] can be removed by one thorough winter spraying with Bordeaux mixture, and the fungous growths can be scraped off and pruned out. Spanish moss, shown in figure 23, is sometimes found on pecan trees. It is not parasitic, can be easily removed from the tree, and should not be allowed to gain a foothold, on account of its unsightliness and the generally neglected appearance which it gives an orchard.

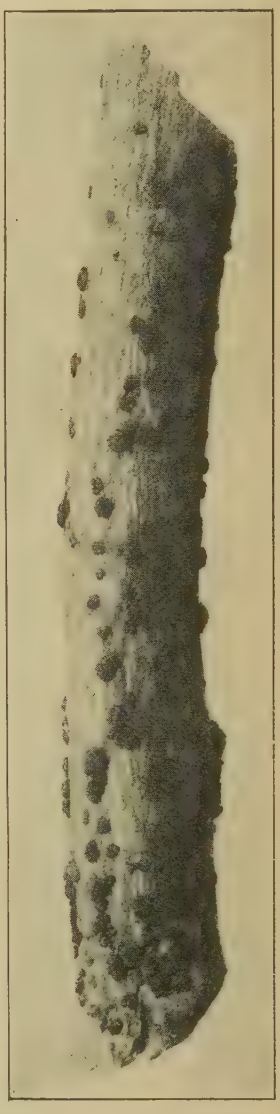

FIG. 21.—A black fungous growth frequently found on pecan trees. This growth is entirely superficial and does no harm.

SPREAD OF PECAN DISEASES.

Various writers have suggested that diseases of the pecan may be expected to become much more serious in time. This belief is based on the known fact that plant diseases of slight importance have sometimes increased in seriousness as the number of host plants in groups increases, thus increasing the opportunity for dissemination. This view overlooks the important fact that the pecan has always grown in groups. In native pecan groves the number of

[18] Waite, M. B. Experiments with fungicides in the removal of lichens from pear trees. *In* Jour. Mycol., v. 7, no. 3, p. 264–268. 1893.

trees in many cases runs into the thousands, and yet for years they have continued to thrive and bear crops.

The mere transplanting of a tree does not necessarily subject it to a new set of parasites. It may do this, as is attested by conspicuous cases in which American plants transplanted to European soil have become the victims of new diseases, and vice versa; but no such process is taking place in transplanting the pecan within the United States.

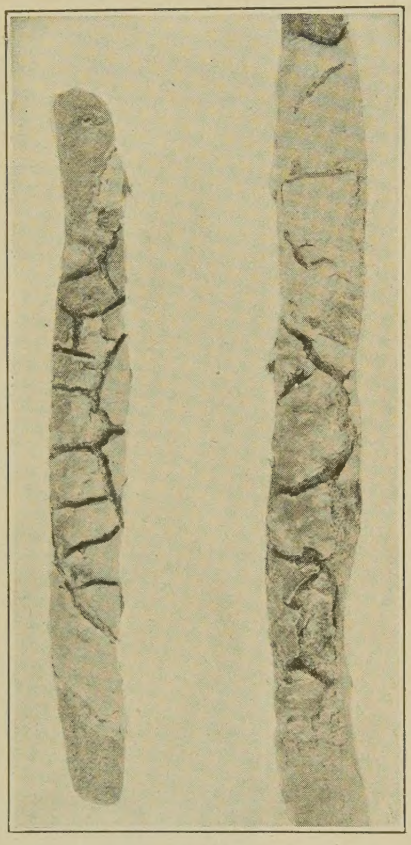

FIG. 22.—An unsightly fungous growth (*Thelephora pedicellata*). It does little or no injury, but mars the appearance of the tree. It may be removed by scraping or by pruning out the affected limbs and twigs.

So far as the writers are informed such diseases as are known to be caused by fungi or by bacteria may be found throughout the southern pecan belt. It is true that scab is very serious on susceptible varieties planted in regions subject to high humidity and heavy summer rains and is a rare disease in the semiarid portions of the Southwest, but it is also true that the planting of highly susceptible varieties in the humid rainy sections is rapidly decreasing.

Rosette has been a serious factor in the planted orchards of the southeastern portion of the country, but it is practically unknown in the native growth on river-bottom soils. The degree of longitude, however, has not been responsible for this. The disease also occurs in the Southwest if trees are set on unsuitable soils. The prevalence of rosette in the Southeast has been due to the fact (1) that there have been many more planted orchards there than in other portions of the country and (2) that through lack of knowledge the planters were not sufficiently discriminating as to soils in selecting orchard sites. It can not be said, however, that this disease is increasing, and it is quite reasonable to suppose that with the wide dissemination of the knowledge that the pecan requires a soil of uniform formation and relatively high fertility and moisture-holding capacity, rosette will decrease.

These facts do not show that pecan diseases are on the increase. On the contrary, they indicate that if due regard is given to the suitability of soils, varieties, and the care of the orchards after they are planted losses from disease may be expected to decrease. Seasonal variations in the occurrence and seriousness of the various troubles will take place, but this is beside the point, and the writers feel that it can be said with confidence that if growers will use discrimination and care in selecting scab-resistant varieties for planting and set such trees only on soils of uniform formation and good fertility diseases need be but a minor consideration.

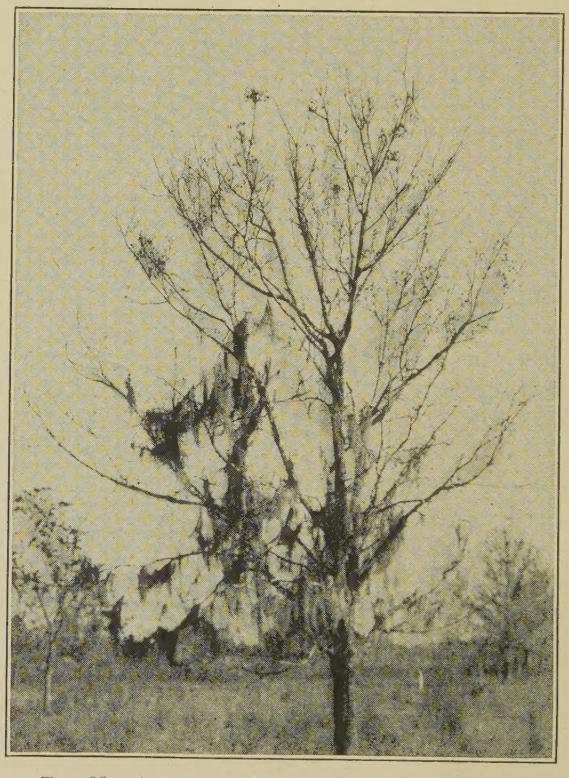

FIG. 23.—A pecan tree draped with Spanish moss.

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